

Appl. No. 10/701,987

Amendt. dated September 6, 2005

Reply to Office Action of July 7, 2005

Amendment to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application.

Please cancel claims 13 - 16:

Listing of Claims:

Claim 1 (original) A freeze tolerant fuel cell power plant (10) for generating an electrical current from hydrogen containing reducing fluid fuel and oxygen containing oxidant reactant streams, the plant comprising:

- 5 a. at least one fuel cell (12) having a proton exchange membrane electrolyte (19);
- 10 b. a coolant loop (42) including a porous water transport plate (44) secured in heat and mass exchange relationship within the fuel cell (12), a coolant circulating means (46) secured to a coolant passage (68) in fluid communication with the porous water transport plate (44) for circulating a coolant through the plate (44) and for transferring water into or out of the plate (44) with the coolant, coolant heat exchanger (52) means secured to the coolant passage (68) for removing heat from the coolant, an accumulator (66) means secured in fluid communication with the coolant passage (68) for storing the coolant and water; and,
- 15 c. wherein the coolant is a two-component mixed coolant circulating through the coolant loop (42), the two-
- 20

Appl. No. 10/701,987
Amendt. dated September 6, 2005
Reply to Office Action of July 7, 2005

component mixed coolant consisting of a water
immiscible fluid component and a water component.

Claim 2 (original) The freeze tolerant fuel cell power plant
(10) of claim 1, wherein the two-component mixed coolant
consists of between 50 and 98 volume percent of a water
immiscible fluid component and between 2 and 50 volume percent
5 of a water component.

Claim 3 (original) The freeze tolerant fuel cell power plant
(10) of claim 1, wherein the two-component mixed coolant
consists of between 80 and 95 volume percent of a water
immiscible fluid component and between 5 and 20 volume percent
5 of a water component.

Claim 4 (original) The freeze tolerant fuel cell power plant
(10) of claim 1, wherein the water immiscible fluid is selected
from the group consisting of silicones, substituted silicones,
siloxanes, polysiloxanes, substituted siloxanes or polysiloxanes
5 and mixtures thereof.

Claim 5 (original) The freeze tolerant fuel cell power plant
(10) of claim 1, wherein the water immiscible fluid is selected
from the group consisting of perfluorocarbons, hydrofluoroethers
and mixtures thereof.

Claim 6 (original) The freeze tolerant fuel cell power plant
(10) of claim 1, wherein the water immiscible fluid is selected
from the group consisting of alkanes, alkenes, alkynes having

Appl. No. 10/701,987

Amendt. dated September 6, 2005

Reply to Office Action of July 7, 2005

six or more carbon atoms and mixtures thereof.

Claim 7 (original) The freeze tolerant fuel cell power plant (10) of claim 1, wherein the water immiscible fluid has a freezing temperature equal to or less than minus ten degrees Celsius and has a surface tension of less than or equal to 35 dynes/cm.

Claim 8 (original) The freeze tolerant fuel cell power plant (10) of claim 1 further comprising a two-component coolant mixing system, including:

- a. a coolant diversion valve (70) for selectively directing none, all or a portion of the two component mixed coolant to flow from the coolant loop (42) to the accumulator (66) means;
- b. a water immiscible fluid feed valve (72) secured in fluid communication between the coolant loop (42) and the accumulator (66) means for selectively directing flow of the water immiscible fluid from the accumulator (66) means into the coolant loop (42);
- c. a suction generating means (74) secured in fluid communication between the coolant loop (42) and the accumulator (66) means for applying a suction force to the accumulator (66) means for withdrawing the water component of the two-component fluid from the accumulator (66) means into the coolant loop (42); and,
- d. a mixer (76) secured in fluid communication with the coolant loop (42) for mixing the water component with

Appl. No. 10/701,987

Amendt. dated September 6, 2005

Reply to Office Action of July 7, 2005

the water immiscible fluid within the coolant loop
(42).

Claim 9 (original) The freeze tolerant fuel cell power plant
(10) of claim 8, further comprising a mixing system by-pass
valve (73) secured in fluid communication with the coolant
passage (68) that selectively directs the coolant from the
5 coolant passage (68) into the accumulator (66) by-passing the
mixing system (69).

Claim 10 (original) The freeze tolerant fuel cell power plant
(10) of claim 1, further comprising:

- a. a plurality of fuel cells (104A, 104B, 104C, 104D)
cooperatively disposed in a fuel cell stack assembly
5 (102);
- b. a plurality of porous water transport plates (106A,
106B, 106C, 106D) secured in heat and mass exchange
relationship with the fuel cells (104A, 104B, 104C,
104D) within the cell stack assembly (102);
- 10 c. a high-volume coolant inlet manifold (108) defined
within the cell stack assembly (102) for directing
flow of the two-component mixed coolant through the
plurality of water transport plates (106A, 106B, 106C,
106D) into a coolant exhaust passage (48) of the
15 coolant loop (42);
- d. a coolant by-pass line (112) secured between the high-
volume coolant inlet manifold (108) and the coolant
exhaust passage (48); and,
- e. wherein the high-volume coolant inlet manifold (108)

Appl. No. 10/701,987
Amendt. dated September 6, 2005
Reply to Office Action of July 7, 2005

20 is dimensioned to receive and direct to the coolant
by-pass line (112) a coolant flow rate that is at
least five times a coolant flow rate of coolant
flowing through the plurality of water transport
plates (106A, 106B, 106C, 106D) from the high volume
25 coolant inlet manifold (108) to the coolant exhaust
passage (48) to enhance mixing of the two-component
mixed coolant flowing through the cell stack assembly
(102).

Claim 11 (original) The freeze tolerant fuel cell power plant
of claim 1, further comprising an antifreeze coolant loop (54)
for circulating an antifreeze coolant through an antifreeze
coolant passage (56), an antifreeze coolant pump (58), the
5 coolant heat exchanger (52), and an antifreeze coolant radiator
(60), for removing heat from the coolant heat exchanger (52) and
the antifreeze coolant.

Claim 12 (original) The freeze tolerant fuel cell power plant
(10) of claim 1, further comprising a heat-exchange by-pass
valve (88) secured in fluid communication with the coolant
passage (68) and with a heat-exchange by-pass line (90) for
5 selectively directing the coolant to by-pass the heat exchanger
(52) and flow back into the coolant passage (68).

Claims 13 - 16 (canceled)